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CLAIMS

[Claim(s)]

[Claim 1] At mass %, it is C. : 0.0018% or less, less than [Si:0.020%], Mn: 0.10-0.30%, P : 0.010 - 0.035%, S : 0.035% or less, less than [aluminum:0.010%], N : 0.0008 - 0.0050%, B : 0.0050% or less and 0.6Ns or more, O : 0.005 - 0.050% is contained. And (N which exists as BN) the steel plate for enamels excellent in the workability, the aging nature, and the enamel property which are characterized by satisfying more than /(N which exists as AlN):10.0, and the remainder consisting of Fe and an unescapable impurity.

[Claim 2] At mass %, it is C. : 0.0018% or less, less than [Si:0.020%], Mn: 0.10-0.30%, P : 0.010 - 0.035%, S : 0.035% or less, less than [aluminum:0.010%], N : 0.0008 - 0.0050%, B : 0.0050% or less and 0.6Ns or more, O : 0.005 - 0.050% is contained. And (N which exists as BN) the steel plate for enamels excellent in the workability, the aging nature, and the enamel property which are characterized by satisfying more than /(content N):0.80 and the remainder consisting of Fe and an unescapable impurity.

[Claim 3] At mass %, it is C. : 0.0018% or less, less than [Si:0.020%], Mn: 0.10-0.30%, P : 0.010 - 0.035%, S : 0.035% or less, less than [aluminum:0.010%], N : 0.0008 - 0.0050%, B : 0.0050% or less and 0.6Ns or more, O : 0.005 - 0.050% is contained. The average diameter of the compound sludge containing a with a 0.005-micrometer or more diameter [0.50 micrometer or less] BN independent or BN And 0.010 micrometers or more, Although a diameter is 0.010 micrometers or less among the compound sludges containing a with a 0.005-micrometer or more diameter [0.50 micrometer or less] BN independent or BN, the rate of the number satisfies 10% or less. The steel plate for enamels excellent in the workability, the aging nature, and the enamel property which are characterized by the remainder consisting of Fe and an unescapable impurity.

[Claim 4] How to manufacture the hot rolled sheet steel for enamels the workability according to claim 1 to 3 characterized by carrying out skin pass pressing down, aging nature, and an enamel property excelled [hot rolled sheet steel] in 5% or less after hot-rolling a cast piece.

[Claim 5] How to manufacture the cold rolled sheet steel for enamels excellent in the workability according to claim 1 to 3 characterized by annealing at the temperature more than recrystallizing temperature, and carrying out skin pass pressing down at 5% or less after hot-rolling a cast piece and cold-rolling it at 60% or more of rates of cold-rolling, aging nature, and an enamel property.

[Claim 6] How to manufacture the steel plate for enamels excellent in the workability according to claim 4 or 5 characterized by hot-rolling a cast piece at :1000-1150 degree C whenever [slab stoving temperature], aging nature, and an enamel property.

[Claim 7] How to manufacture the steel plate for enamels excellent in the workability according to claim 4 to 6 characterized by hot-rolling a cast piece and rolling round at 650-750 degrees C, aging nature, and an enamel property.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the steel plate for enamels which was excellent in the enamel property which can be acquired by low cost, the working characteristic, and the aging property, and its manufacture approach.

[0002]

[Description of the Prior Art] The steel plate for the former and enamels carries out decarbonization denitridification annealing, and is several 10 ppm about Content C and N. It has been manufactured by making it decrease below. However, such decarbonization denitridification annealing had the fault that productivity was low and a manufacturing cost became high.

[0003] In order to avoid decarbonization denitridification annealing, the steel plate for enamels by the super-low carbon steel which reduced the amount of content C to several 10 ppm with degasifying at the steel-manufacture event is indicated by JP,6-122938,A, the patent No. 2951241 official report, etc. In these techniques, in order to solve the adverse effect of the dissolution C which remains slightly, or Dissolution N, Ti, Nb, etc. are added and deep drawability and aging-proof nature are raised.

[0004] However, by this approach, while becoming easy to generate the bubble and sunspot defect resulting from carbide and a nitride, there was a problem that a manufacturing cost will rise for alloy costs, such as Ti and Nb.

[0005] As a steel plate which can solve these problems, although some drawability is inferior, the steel plate for enamels and the manufacture approach of having suppressed addition of Ti, Nb, etc. are indicated by JP,8-27522,A, JP,9-137250,A, and JP,10-212546,A. These mainly use B for immobilization of N.

[0006] However, according to the technique of this official report, reduction of Dissolution C was not enough, and aging degradation was carried out for buildup of N by remelting depending on manufacture conditions, while a nitride anneals, and while there was a problem of spoiling press-forming nature, there was a trouble of being easy to generate a bubble and a sunspot defect for the generation of gas by the nitride decomposition under enamel baking etc.

[0007]

[Problem(s) to be Solved by the Invention] This invention conquers the trouble of the conventional steel plate for enamels which was mentioned above, and aims at offering the bubble-proof of non-aging, the steel plate for right workability enamels of the low cost excellent in sunspot nature, and its manufacturing method.

[0008]

[Means for Solving the Problem] this invention -- the former -- a steel plate -- a steel plate -- a manufacturing method -- a fault -- conquering -- a sake -- versatility -- examination -- in piles -- obtaining -- having had -- a thing -- it is -- an enamel -- ** -- a steel plate -- aging -- a sex -- and -- an enamel -- a property -- ***** -- chemical composition -- manufacture -- conditions -- effect -- having inquired -- a result -- obtaining -- having had -- the following -- (-- one --) - (-- five --) --

knowledge -- being based -- a thing -- it is .

[0009] (1) In order to control generating of aging nature and a bubble, and a sunspot, it is inadequate just to add a carbide formation element, and it is necessary to reduce the absolute value of the amount of content C below in the amount of specification.

(2) Generating of aging nature and a bubble, and a sunspot is influenced by the class of nitride, and its property improves by making B nitride form from aluminum nitride.

(3) Generating of aging nature and a bubble, and a sunspot is influenced by the gestalt of B nitride, and its property improves by controlling the amount and magnitude of B nitride in the specific range.

(4) In order to control the condition of a nitride like the above, N and not only the amount of B but control of the amount of O and hot-rolling conditions is especially effective.

(5) In the steel which controlled appropriately the condition of C, P, N, the amount of B, and a nitride, the range of the optimal skin pass rolling reduction for keeping aging-proof nature and workability good becomes large.

This invention is based on the above data and the summary is as follows.

[0010] (1) By mass % C : [0.0018% or less,] Si: Less than [0.020%], Mn: 0.10-0.30% P : 0.010 - 0.035%, S : [0.035% or less,] aluminum: Less than [0.010%], N : [0.0008 - 0.0050%,] B : [0.0050% or less and 0.6Ns or more,] O : steel plate for enamels excellent in the workability, the aging nature, and the enamel property which are characterized by containing 0.005 - 0.050%, and (N which exists as BN) satisfying more than /(N which exists as AlN):10.0, and the remainder consisting of Fe and an unescapable impurity.

[0011] (2) By mass % C : [0.0018% or less,] Si: Less than [0.020%], Mn: 0.10-0.30% P : 0.010 - 0.035%, S : [0.035% or less,] aluminum: Less than [0.010%], N : [0.0008 - 0.0050%,] B : [0.0050% or less and 0.6Ns or more,] O : Steel plate for enamels excellent in the workability, the aging nature, and the enamel property which are characterized by containing 0.005 - 0.050%, and (N which exists as BN) satisfying more than /(content N):0.80, and the remainder consisting of Fe and an unescapable impurity.

[0012] (3) By mass % C : [0.0018% or less,] Si: Less than [0.020%], Mn: 0.10-0.30% P : 0.010 - 0.035%, S : [0.035% or less,] aluminum: Less than [0.010%], N : [0.0008 - 0.0050%,] B : [0.0050% or less and 0.6Ns or more,] O The average diameter of the compound sludge which contains 0.005 - 0.050% and contains a with a 0.005-micrometer or more diameter [0.50 micrometer or less] BN independent or BN : [0.010 micrometers or more,] Although a diameter is 0.010 micrometers or less among the compound sludges containing a with a 0.005-micrometer or more diameter [0.50 micrometer or less] BN independent or BN, the rate of the number satisfies 10% or less. The steel plate for enamels excellent in the workability, the aging nature, and the enamel property which are characterized by the remainder consisting of Fe and an unescapable impurity.

[0013] (4) How to manufacture the hot rolled sheet steel for enamels the workability, the aging nature, and the enamel property of a publication excelled [hot rolled sheet steel] in the above (1) characterized by carrying out skin pass pressing down at 5% or less thru/or either of (3) after hot-rolling a cast piece.

[0014] (5) How to manufacture the cold rolled sheet steel for enamels the workability, the aging nature, and the enamel property of a publication excelled [cold rolled sheet steel] in the above (1) characterized by annealing at the temperature more than recrystallizing temperature, and carrying out skin pass pressing down at 5% or less after hot-rolling a cast piece and cold-rolling it at 60% or more of rates of cold-rolling thru/or either of (3).

[0015] (6) How to manufacture the steel plate for enamels the workability, the aging nature, and the enamel property of a publication excelled [steel plate] in the above (4) characterized by hot-rolling a cast piece at :1000-1150 degree C whenever [slab stoving temperature], or (5).

[0016] (7) How to manufacture the steel plate for enamels the workability, the aging nature, and the enamel property of a publication excelled [steel plate] in the above (4) characterized by hot-rolling a cast piece and rolling round at 650-750 degrees C thru/or either of (6).

[0017]

[Embodiment of the Invention] This invention is explained in full detail below. First, a steel presentation

is explained in full detail. Although it is known that workability will become good from the former, so that it is low, in order to acquire good aging-proof nature, workability, and an enamel property, by this invention, it is necessary to make C 0.0018% or less. The desirable range is 0.0015% or less. Although especially a minimum does not need to limit, since steel-manufacture cost will be raised if the amount of C is lowered, it is desirable to make 0.0005% into a minimum practical.

[0018] Since it checks an enamel property, it is necessary not to dare add, and little Si is so desirable that there is. comparable as the usual steel plate for enamels -- it is 0.010% or less preferably 0.020% or less.

[0019] Mn is a component which influences an enamel property in relation to oxygen and the amount of S. At the time of hot rolling, it is the element which prevents the hot shortness resulting from S, and 0.10% or more is simultaneously required of this invention containing many oxygen. On the other hand, since enamel adhesion will worsen and it will become easy to generate a bubble and a sunspot if the amount of Mn becomes high, an upper limit is made into 0.30%.

[0020] If the diameter of crystal grain will make it big and rough, aging nature will become large, if there are few contents, and a content exceeds 0.035% on the other hand, P will stiffen an ingredient, will degrade braces workability, and also speeds up [acid-washing] at the time of enamel pretreatment, and makes the smut leading to a bubble and a sunspot increase. Therefore, in this invention, P content is specified to 0.010 - 0.035%.

[0021] S increases the amount of smut at the time of acid washing of enamel pretreatment, and since a bubble and a sunspot are made easy to generate, it may be 0.035% or less.

[0022] When not much many aluminum is made to contain, it becomes impossible to control the inside O of steel to limited within the limits. Moreover, in control of a nitride, since aluminum nitride reacts with the moisture under enamel baking, generates gas and tends to cause a bubble defect, it is not desirable. For this reason, a content is limited to 0.010% or less.

[0023] N is an important element in order to control the condition of BN in this invention. From a viewpoint of aging nature, and a bubble-proof and sunspot nature, it is so desirable that it is few, and at 0.0008% or less, since it is unnecessary, B addition which is the requirement of this invention steel sets 0.0008% or more as the object of this invention. An upper limit is made into 0.0050% or less on balance with the amount which is determined by relation with the amount of oxygen in steel and which can be B contained. It is 0.0040% or less preferably.

[0024] It is an important element in order that B may also control the condition of BN in this invention. Although it is so desirable that controlling the condition of BN good has many B contents, if you are going to make it contain so much, since the yield in a steel-manufacture process falls, let 0.0050% be an upper limit with this invention steel containing many O. A minimum may be 0.60 or more times of the amount of content N.

[0025] O influences enamel adhesion, and a bubble-proof and sunspot nature in relation to the amount of Mn at the same time it influences **** jump nature directly. 0.005% is required to demonstrate such effectiveness. On the other hand, since will reduce the addition yield of B at the time of steel manufacture, it will become impossible to maintain the condition of good B nitride and workability, aging nature, and a bubble-proof and sunspot nature will be worsened if the amount of O becomes high, an upper limit is specified to 0.050%. The desirable range is 0.010 - 0.045%.

[0026] In addition, the amount required in order to acquire a good enamel property of O is influenced of the amount of B. Although O was required of the conventional steel plate for enamels about 0.02%, with the steel which contains B in this invention range, also in the smaller amount of O, a good enamel property is shown and ****-proof jump nature becomes good especially. This is considered for existence of B to affect the gestalt of the oxide in a steel-manufacture phase. this is guessed by superfluous B addition also from the amount of need O carrying out until [comparable] lifting with steel conventionally. The effect the amount of B affects the amount of proper O to **** jump nature is shown in drawing 1 .

[0027] The important conditions in this invention are the class of B nitride, and control of an amount, and set to (N which exists as BN) / (N which exists as AlN) >10.0, or (N which exists as BN) /(content

N) > 0.80. It is /(N which exists as BN) (N which exists as AlN) > 20.0, or (N which exists as BN) / (content N) > 0.90 preferably.
 [0028] although this reason is not clear -- N -- a nitride -- it thinks because it is effective in aging-proof nature, and a bubble-proof and sunspot nature to fix as a stable B nitride considered to be hard to decompose it in an annealing process or an enamel baking process.

[0029] It is the value which analyzed B and aluminum in **** when dissolving here, and (N which exists as BN) (N which exists as AlN) a steel plate in an iodine alcoholic solution, and was converted into the amount of N by making this into the whole quantity BN and AlN, respectively.

[0030] Moreover, it is an important factor for the size distribution of BN to also raise aging-proof nature, and a bubble-proof and sunspot nature. In this invention, about the compound sludge containing a BN independent and BN, although a diameter is 0.010 micrometers or less among with a 0.005-micrometer or more diameter [0.5 micrometer or less] things, the average diameter of a with 10% or less or a 0.005-micrometer or more diameter [0.5 micrometer or less] thing is restricted for the rate of the number with 0.010 micrometers or more.

[0031] Although this reason is not clear, although it is stability, since a less than 0.010-micrometer detailed thing is unstable and it is easy to decompose in elevated-temperature conditions, such as annealing and an enamel baking process, B nitride is because it is thought that aging-proof nature, and a bubble-proof and sunspot nature are degraded.

[0032] The number and diameter of this sludge are the value which may have the diameter and number of sludges measured about the visual field which is extent which observes the extract replica obtained from the steel plate by the SPEED method with an electron microscope, and does not have a bias. A photograph of a number visual field can be taken, and performing image analysis etc. can also ask for a size distribution.

[0033] The reason for having set the target diameter of BN to 0.005 micrometers or more is for being unable to say that it is perfect, even if it carries out the quantum and qualitative analysis of a detailed sludge with the newest measurement technique, but being easy to produce gross errors. Moreover, the reason for having set the target diameter of BN to 0.50 micrometers or less is because this may be measured and an error may be given to the measurement result of the target nitride, when B contains in the big and rough oxide contained so much with this invention steel.

[0034] Therefore, by this invention, a generic claim is specified in connection with the sludge of the magnitude which can expect that a measurement error will become smaller. Moreover, although what the configuration extended may be seen in what carried out the compound deposit especially with MnS, let the average of a major axis and a minor axis be the diameter of the sludge about what has a not isotropic configuration.

[0035] Adding about 0.02%, in order for Cu to control the acid-washing rate at the time of enamel pretreatment, to know well that there is work which raises adhesion and for a cliff enamel to draw out work of Cu once especially does not check the effectiveness of this invention. However, since the adhesion in a low acid-washing time amount region will fall if acid-washing depressant action is too strong, since there is very little dissolution C and N, also when adding this invention, the upper limit should be stopped to about 0.04%.

[0036] Especially carbon nitride formation elements, such as Ti and Nb, are not added with this invention steel, although it is usually added in order to raise deep drawability. However, if it is the amount of extent contained unescapable from an ore, a scrap, etc., there will be no big adverse effect. Although content of V, Mo, W, and other carbon nitride formation elements is considered besides Ti and Nb, when it shall represent with two sorts of elements, Ti and Nb, this amount is 0.006% or less preferably 0.010% or less in the sum total of two elements.

[0037] Next, the manufacture approach is explained. The condition of the sludge in this invention is faced performing hot-rolling, cold-rolling, and a skin pass after casting the steel of the component of this invention, and is acquired by combining these. The desirable conditions are as follows.

[0038] As for casting, the effectiveness of this invention is acquired in any approaches. for controlling B nitride as mentioned above -- the effect of whenever [slab stoving temperature / at the time of hot-rolling], and, rolling-up temperature -- large -- the reheating temperature of slab -- 1000-1150 degrees C

-- and -- or -- if rolling-up temperature is made into 650-750 degrees C -- the deposit rate and sludge size distribution of BN -- the inside of the range of this invention -- nearby -- it changes in the desirable direction. Moreover, it is also effective after rough rolling in the middle of a hot-rolling process like continuation hot-rolling to carry out elevated-temperature maintenance of the coiled form steel strip. 60% or more of cold rolling is desirable in order to obtain the good steel plate of deep drawability. When you need especially deep drawability, considering as 75% or more is desirable.

[0039] If continuous annealing of the effectiveness of this invention is also unchanging and box annealing of annealing is also the temperature more than recrystallizing temperature, the effectiveness of this invention will be demonstrated. From a viewpoint of low-cost-izing which is especially the description of this invention, continuous annealing is desirable. Since this invention steel has the description that recrystallization also completes short-time annealing at 630 degrees C, it is not necessary to anneal it especially at an elevated temperature.

[0040] Skin pass rolling is performed in order to suppress configuration correction of a steel plate, or yield point elongation generating at the time of processing. Although the skin pass of the range of about 0.6 - 2% of rolling reduction is usually performed in order to suppress yield point elongation, avoiding degradation of the workability (elongation) by strip processing, even when he has no skin pass, generating of yield point elongation is suppressed, and this invention steel has small degradation of workability also in the comparatively high rate of a skin pass. For this reason, the skin pass range of this invention steel is made into 5.0% or less. By this invention, since skin pass rolling may not be carried out, the expression of the above "5.0% or less" means that "0" is included.

[0041]

[Example] Hot rolling, cold rolling, annealing, and temper rolling were performed on the conditions which show the continuous casting slab which consists of various chemical composition shown in a table 1 in a table 2. The condition of the nitride of a steel plate is shown in a table 2, and a mechanical property and an enamel property are shown in a table 3.

[0042] A mechanical characteristic is based on the tensile test by the JIS No. 5 test piece. An aging index (A.I. Artificial Intelligence) gives 10% of prestrain by ****, and is a stress difference before and behind aging for 100 degree-Cx 60 minutes.

[0043] The process shown in a table 4 estimated the enamel property. Among enamel properties, the surface characteristic of a bubble and a sunspot chose 20 minutes and long conditions, and evaluated acid-washing time amount by the viewing. Acid-washing time amount estimated enamel adhesion by short conditions as 3 minutes. Moreover, in order that a difference might not appear in adhesion, enamel adhesion dropped the weight of a 2kg ballhead from 1m height, measured the enamel desquamative state of a variant part with 169 palpation needles, and evaluated it by the P.E.I. adherence test approach (ASTM C 313-59) usually performed at the rate of area of a non-exfoliated part.

[0044] pretreatment without acid-washing time amount 3 minutes, and nickel immersion of ****-proof jump nature -- giving -- 1 direct time -- applying -- business -- after having performed glazing and desiccation, inserting the cover coat in the 850-degree C firing furnace for 3 minutes at 50 degrees C of dew-points and calcinating, the **** jump accelerated test put in into a 160-degree C thermostat for 10 hours was performed, and the **** jump generating situation was judged visually. [steel plate / of three sheets]

[0045] The steel plate of this invention has good workability (elongation), and its aging-proof nature is also good, and it is the steel plate for enamels which was excellent also in the enamel property so that clearly from the result of a table 3.

[0046]

[A table 1]

鋼	C	Si	Mn	P	S	Al	N	B	O	Ti	Nb	B/N
a	0.0015	0.005	0.25	0.013	0.022	0.001	0.0023	0.0031	0.037	0.002	0.001	1.35
b	0.0012	0.008	0.11	0.016	0.018	0.002	0.0016	0.0016	0.016	0.001	0.001	1.00
c	0.0016	0.011	0.08	0.015	0.025	0.002	0.0032	0.0038	0.020	0.003	0.001	1.19
d	0.0010	0.008	0.19	0.021	0.014	0.003	0.0022	0.0020	0.013	0.000	0.001	0.91
e	0.0018	0.006	0.22	0.026	0.020	0.001	0.0034	0.0021	0.033	0.001	0.000	0.62
f	0.0017	0.009	0.25	0.008	0.007	0.001	0.0043	0.0030	0.040	0.000	0.000	0.70
g	0.0014	0.012	0.16	0.015	0.025	0.004	0.0030	0.0023	0.022	0.002	0.002	0.78
h	0.0020	0.010	0.15	0.007	0.021	0.001	0.0035	0.0024	0.046	0.001	0.000	0.69
i	0.0009	0.004	0.14	0.020	0.020	0.003	0.0033	0.0019	0.035	0.004	0.000	0.58
j	0.0012	0.002	0.10	0.011	0.018	0.004	0.0052	0.0058	0.009	0.002	0.002	1.12
k	0.0011	0.008	0.22	0.023	0.014	0.002	0.0052	0.0036	0.014	0.003	0.001	0.69
l	0.0016	0.009	0.21	0.025	0.020	0.002	0.0021	0.0016	0.027	0.002	0.009	0.76
m	0.0014	0.006	0.23	0.026	0.022	0.001	0.0036	0.0038	0.030	0.010	0.002	1.06
n	0.0012	0.006	0.20	0.016	0.022	0.009	0.0014	0.0018	0.009	0.004	0.004	1.29
o	0.0011	0.005	0.20	0.016	0.022	0.005	0.0025	0.0020	0.005	0.002	0.001	0.80
p	0.0009	0.004	0.15	0.020	0.020	0.012	0.0026	0.0022	0.003	0.003	0.001	0.85

[0047]

[A table 2]

No.	鋼	熱延温度/℃		冷延率 (%)	焼純 (℃×分)	スキンバ ス(%)	式1	式2	RA / μm	RS(%)
		加熱	巻取り							
1	a	1200	600	75	750×1	0.6	>20	0.87	0.021	6
2		1050	640	80	775×1	0.6	>20	1.00	0.018	2
3		1200	730	80	775×1	0.6	18.5	0.86	0.024	8
4	b	1200	600	60	750×1	0.8	14.1	0.75	0.015	20
5		1150	730	-	-	1.0	15.5	0.89	0.020	10
6	c	1150	720	80	700×1	1.0	17.4	0.90	0.016	5
7	d	1200	690	65	775×1	1.0	17.5	0.89	0.016	8
8		1200	690	65	775×1	0.0	17.5	0.89	0.016	8
9		1200	690	65	775×1	3.0	17.5	0.89	0.016	8
10		1200	690	65	775×1	5.0	17.5	0.89	0.016	8
11	e	1200	650	80	750×1	0.8	12.5	0.91	0.018	8
12		1250	650	80	750×1	0.8	9.8	0.86	0.013	12
13		1250	550	80	750×1	0.8	9.4	0.75	0.009	20
14	f	1200	630	70	725×1	0.8	>20	0.83	0.016	5
15		1250	600	70	725×1	0.8	14.0	0.77	0.008	20
16		1250	550	70	725×1	0.8	8.8	0.70	0.007	35
17	g	1250	630	60	750×1	0.8	13.1	0.98	0.029	2
18		1250	600	60	800×1	0.8	12.4	0.83	0.020	10
19		1250	600	60	825×1	0.8	12.4	0.78	0.009	40
20	h	1200	680	75	725×1	1.0	18.8	1.00	0.021	5
21		1200	680	75	725×1	0.0	18.8	1.00	0.021	5
22		1200	680	75	725×1	3.0	18.8	1.00	0.021	5
23		1200	680	75	725×1	5.0	18.8	1.00	0.021	5
24	i	1150	710	85	750×1	0.8	9.5	0.84	0.018	15
25		1050	750	85	750×1	0.8	9.8	0.81	0.015	8
26	j	1100	690	75	725×1	1.0	>20	0.95	0.025	5
27	k	1150	610	65	750×1	1.0	16.4	0.80	0.017	15
28		1150	610	65	750×1	2.0	16.4	0.80	0.017	15
29	l	1150	600	60	775×1	0.6	18.6	0.87	0.011	8
30	m	1150	650	70	775×1	0.8	>20	0.87	0.014	6
31	n	1100	670	70	775×1	0.8	15.0	0.85	0.018	5
32	o	1150	700	75	800×1	0.8	14.8	0.92	0.032	2
33	p	1100	700	70	775×1	0.8	9.1	0.79	0.022	4

[0048]
[A table 3]

鋼	機械的特性			時効性	ほうろう特性			備考
	YP/MPa	TS/MPa	EI(%)		AI/MPa	耐つまとび性	密着(%)	
1	150	296	53	0.0	◎	100	◎	◎発明鋼
2	162	298	55	0.0	◎	100	◎	◎発明鋼
3	149	276	58	0.0	◎	100	◎	◎発明鋼
4	166	290	52	0.0	◎	100	○	○発明鋼
5	152	290	50	0.2	◎	100	◎	◎発明鋼
6	175	313	48	0.0	◎	100	◎	◎発明鋼
7	149	288	56	0.0	◎	100	◎	◎発明鋼
8	140	286	58	0.5	◎	100	◎	◎発明鋼
9	160	292	54	0.0	◎	100	◎	◎発明鋼
10	170	305	53	0.0	◎	100	◎	◎発明鋼
11	160	292	52	0.0	◎	100	◎	◎発明鋼
12	161	300	52	0.0	◎	100	○	○発明鋼
13	168	310	53	0.0	◎	80	×	×比較鋼
14	165	300	52	0.0	◎	100	○	○発明鋼
15	172	299	48	0.0	◎	100	○	○発明鋼
16	174	306	47	0.0	◎	90	○	○発明鋼
17	162	290	52	0.0	◎	100	○	○発明鋼
18	154	280	55	0.0	◎	100	○	○発明鋼
19	141	269	57	0.4	○	90	○	○発明鋼
20	162	298	50	5.6	◎	100	◎	×比較鋼
21	150	306	52	23.4	◎	100	◎	×比較鋼
22	168	306	44	1.4	◎	100	◎	×比較鋼
23	177	315	42	0.0	◎	100	◎	×比較鋼
24	152	290	52	0.0	◎	95	×	×比較鋼
25	149	281	57	0.0	◎	100	×	×比較鋼
26	165	297	49	0.0	×	100	◎	×比較鋼
27	156	300	50	7.0	○	100	×	×比較鋼
28	162	308	45	0.0	○	100	×	×比較鋼
29	146	296	55	0.0	◎	90	×	×比較鋼
30	142	290	54	0.0	◎	90	×	×比較鋼
31	160	298	51	0.0	◎	100	◎	○発明鋼
32	160	311	50	0.0	○	100	◎	○発明鋼
33	162	297	50	0.0	×	100	◎	×比較鋼

[0049]
 [A table 4]

工程	条件
1 脱脂	アルカリ脱脂
2 湿洗	
3 水洗	
4 酸洗	15%H ₂ SO ₄ , 75°C×3, 20分浸漬
5 水洗	
6 Ni処理	2%NiSO ₄ , 70°C×3分浸漬
7 水洗	
8 中和	2%Na ₂ CO ₃ , 75°C×5分浸漬
9 乾燥	
10 錆転	直接1回かけ転写、100μm厚
11 乾燥	160°C×10分
12 焼成	840°C×3分

[0050]

[Effect of the Invention] The steel plate for enamels of this invention has good workability, and fulfills the still more nearly required ****-proof jump nature as a steel plate for enamels, enamel adhesion, and all the surface characteristics. Since the steel plate which was excellent in workability and aging-proof nature can be manufactured even if it does not use an expensive element like Ti and Nb addition steel like the conventional hyperoxia steel especially, not using decarbonization or decarbonization denitrification annealing, the reduction effectiveness of cost is also large, and industrial meaning is large.

[Translation done.]

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<i>DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI; PLUR=YES; OP=OR</i>			
<input type="checkbox"/>	L10	L9 and 148/330.ccls.	96
<input type="checkbox"/>	L9	(c or carbon) and (n or nitrogen) and (b or boron) and (BN or nitride)	199232
<i>DB=USPT; PLUR=YES; OP=OR</i>			
<input type="checkbox"/>	L8	5385617	1
<i>DB=USPT,PGPB,JPAB,EPAB; PLUR=YES; OP=OR</i>			
<input type="checkbox"/>	L7	(US-3988173-A)![did]	1
<i>DB=EPAB,JPAB,DWPI; PLUR=YES; OP=OR</i>			
<input type="checkbox"/>	L6	L4 same (diameter or length or size)	63
<input type="checkbox"/>	L5	L4 same (o or oxygen or o2)	68
<input type="checkbox"/>	L4	steel same (n or nitrogen) same (b or boron) same nitride	325
<i>DB=JPAB; PLUR=YES; OP=OR</i>			
<input type="checkbox"/>	L3	L2 same (bn or (boron near nitride))	40
<input type="checkbox"/>	L2	steel same (n or nitrogen) same (b or boron) same nitride	136
<input type="checkbox"/>	L1	steel same (n or nitrogen) same (b or boron) same (o or o2 or oxygen)same nitride	25

END OF SEARCH HISTORY